1. A nucleic acid sensor for detecting target nucleic acid, the nucleic acid sensor comprising:

a) an electrode;

b) redox polymer disposed on the electrode;

c) enzyme disposed on the electrode; and

d) a sensor nucleic acid coupled to the redox polymer,

wherein, in the presence of a substrate, the enzyme generates a detection compound, and wherein binding of the sensor nucleic acid to the target nucleic acid results in an increased rate of oxidation or reduction of the detection compound.

2. The nucleic acid sensor according to claim 1 wherein the redox polymer comprises a redox hydrogel.

3. The nucleic acid sensor according to claim 1 wherein the enzyme is immobilized in the redox polymer.

4. The nucleic acid sensor according to claim 1 wherein the enzyme generates hydrogen peroxide as the detection compound.

5. The nucleic acid sensor according to claim 1 wherein the enzyme is choline oxidase, hydroxylase, or hydrolase.

6. The nucleic acid sensor according to claim 1 further comprising the substrate.

7. An array comprising a plurality of electrically isolated nucleic acid sensors of claim 1 disposed on a substrate.

8. The array according to claim 7 wherein the sensor nucleic acids of at least two of the nucleic acid sensors are different.

9. An array comprising:

a) a plurality of electrically isolated nucleic acid sensors, each nucleic acid sensor comprising:

(i) an electrode;

(ii) redox polymer disposed on the electrode;

(iii) enzyme disposed on the electrode; and

(iv) a sensor nucleic acid coupled to the redox polymer; and

b) one or more flow channels disposed on the array, each flow channel having a width of 200 μm or less,

wherein, in the presence of a substrate, the enzyme generates a detection compound, and wherein binding of the sensor nucleic acid to the target nucleic acid results in an increased rate of oxidation or reduction of the detection compound.

10. The array according to claim 9 wherein the enzyme is immobilized in the redox polymer.

11. The array according to claim 9 wherein the sensor nucleic acids of at least two of the nucleic acid sensors are different.

12. A method for detecting target nucleic acid, the method comprising steps of:

a) providing an array comprising a plurality of electrically isolated nucleic acid sensors, wherein each nucleic acid sensor comprises:

(i) an electrode;

(ii) redox polymer disposed on the electrode;

(iii) enzyme, wherein, in the presence of a substrate, the enzyme generates a detection compound; and

(iv) a sensor nucleic acid coupled to the redox polymer;

b) contacting the array with the target nucleic acid under conditions suitable for hybridization of the target nucleic acid to the sensor nucleic acid of one or more of the nucleic acid sensors;

c) providing a substrate for the enzyme to generate a detection compound;

d) generating a current as a result of an increased rate of oxidation or reduction of the detection compound; and

e) correlating current generated at one or more electrodes with hybridization of the target nucleic acid with the sensor nucleic acid of the one or more electrodes.

13. The method according to claim 12 wherein the enzyme is disposed on the electrode.

14. The method according to claim 12 wherein the enzyme is immobilized in the redox polymer.

15. The method according to claim 12 wherein the current is generated by a catalyst coupled to the target nucleic acid.

16. The method according to claim 15 wherein the catalyst is a thermostable enzyme.

17. The method according to claim 15 wherein the catalyst is peroxidase.

18. The method according to claim 12 further comprising determining the nucleic acid sequence of the target nucleic acid.

19. The method according to claim 12 wherein the step of contacting the array with the target nucleic acid comprises controlling stringency of the hybridization of the target nucleic acid to the sensor nucleic acid using temperature.

20. The method according to claim 12 wherein the step of contacting the array with the target nucleic acid under conditions suitable for hybridization of the target nucleic acid to the sensor nucleic acid comprises contacting the array with the target nucleic

acid at a temperature that is less than a melting temperature when the target nucleic acid and the sensor nucleic acid are not mismatched, and the temperature is greater than a melting temperature when the target nucleic acid and the sensor nucleic acid have at least four mismatches.

21. The method according to claim 12 wherein the step of contacting the array with the target nucleic acid under conditions suitable for hybridization of the target nucleic acid to the sensor nucleic acid comprises contacting the array with the target nucleic acid at a temperature that is less than a melting temperature when the target nucleic acid and the sensor nucleic acid are not mismatched, and the temperature is greater than a melting temperature when the target nucleic acid and the sensor nucleic acid have at least one mismatch.

22. The method according to claim 12 wherein the step of contacting the array with the target nucleic acid under conditions suitable for hybridization of the target nucleic acid to the sensor nucleic acid comprises contacting the array with the target nucleic acid at a temperature that is between a melting temperature when the target nucleic acid and the sensor nucleic acid are not mismatched and a temperature that is 5° C less than the melting temperature.

23. The method according to claim 12 wherein the step of contacting the array with the target nucleic acid under conditions suitable for hybridization of the target nucleic acid to the sensor nucleic acid comprises contacting the array with the target nucleic acid at a temperature that is between a melting temperature when the target nucleic acid and the sensor nucleic acid are not mismatched and a temperature that is 20° C less than the melting temperature.

24. The method according to claim 12 further comprising diagnosing a disease.

25. A method for detecting target nucleic acid comprising:

a) providing an array comprising a plurality of electrically isolated nucleic acid sensors, wherein each nucleic acid sensor comprises:

(i) an electrode;

(ii) redox polymer disposed on the electrode;

(iii) enzyme, wherein, in the presence of a substrate, the enzyme generates a detection compound; and

(iv) a sensor nucleic acid coupled to the redox polymer;

b) contacting the array with the target nucleic acid under conditions suitable for hybridization of the target nucleic acid to the sensor nucleic acid of one or more of the nucleic acid sensors;

c) providing a probe nucleic acid that is capable of hybridizing to the target nucleic acid, wherein the probe nucleic acid is coupled to a catalyst;

d) generating a current by allowing the catalyst to catalyze an electrochemical reaction of the detection compound upon hybridization of the sensor nucleic acid and the probe nucleic acid to the target nucleic acid; and

e) correlating the current generated at one or more electrodes with hybridization of the target nucleic acid with the sensor nucleic acid of the one or more electrodes and the probe nucleic acid.

26. The method according to claim 25 further comprising determining the nucleic acid sequence of the target nucleic acid.

27. The method according to claim 25 further comprising diagnosing a disease.

28. The method according to claim 25 wherein the catalyst is a thermostable enzyme.

29. The method according to claim 25 wherein the catalyst is peroxidase.

30. The method according to claim 25 wherein the enzyme is disposed on the electrode.

31. The method according to claim 30 wherein the enzyme is immobilized in the redox polymer.

32. The method according to claim 25 wherein the step of contacting the array with the target nucleic acid under conditions suitable for hybridization of the target nucleic acid to the sensor nucleic acid of one or more of the nucleic acid sensors is performed simultaneously with the step of providing a probe nucleic acid that is capable of hybridizing to the target nucleic acid.

33. A kit for detecting target nucleic acid comprising:

a) a nucleic acid sensor comprising:

(i) an electrode;

(ii) redox polymer disposed on the electrode;

(iii) enzyme, wherein, in the presence of a substrate, the enzyme generates a detection compound; and

(iv) a sensor nucleic acid coupled to the redox polymer; and

b) a probe nucleic acid, wherein the probe nucleic acid is coupled to a catalyst, wherein the catalyst catalyzes an electrochemical reaction of the detection compound upon hybridization of the sensor nucleic acid and the probe nucleic acid to the target nucleic acid.

34. The kit according to claim 33 wherein the enzyme is disposed on the electrode.

35. The kit according to claim 34 wherein the enzyme is immobilized in the redox polymer.

36. The kit according to claim 33, wherein the nucleic acid sensor is one of a plurality of electrically isolated nucleic acid sensors of an array.

37. The kit according to claim 36 wherein each nucleic acid sensor comprises:

a) an electrode;

b) redox polymer disposed on the electrode;

c) enzyme, wherein, in the presence of a substrate, the enzyme generates a detection compound; and

d) a sensor nucleic acid coupled to the redox polymer.

38. The kit according to claim 37 wherein the enzyme is disposed on the electrode.

39. The kit according to claim 38 wherein the enzyme is immobilized in the redox polymer.

40. The kit according to claim 36 wherein the sensor nucleic acid of at least two of the nucleic acid sensors are different.

41. The kit according to claim 33 wherein the catalyst coupled to the probe nucleic acid comprises a thermostable enzyme.

42. The kit according to claim 33 wherein the catalyst is peroxidase, glucose oxidase, glucose dehydrogenase, lactose oxidase, or lactose dehydrogenase.

43. The kit according to claim 33 further comprising a substrate for the enzyme.

44. The kit according to claim 43 wherein the substrate is hydrogen peroxide, glucose, or choline.

45. A kit for detecting target nucleic acid comprising:

a) a nucleic acid sensor comprising:

(i) an electrode;

(ii) redox polymer disposed on the electrode; and

(iii) a sensor nucleic acid coupled to the redox polymer; and

b) a probe nucleic acid, wherein the probe nucleic acid is coupled to a thermostable enzyme,

wherein the thermostable enzyme catalyzes an electrochemical reaction of a detection compound upon hybridization of the sensor nucleic acid and the probe nucleic acid to the target nucleic acid.

46. The kit according to claim 45 wherein the nucleic acid sensor further comprises an enzyme, wherein, in the presence of a substrate, the enzyme generates the detection compound.

47. The kit according to claim 46 wherein the enzyme is disposed on the electrode.

48. The kit according to claim 47 wherein the enzyme is immobilized in the redox polymer.

49. A method of making a nucleic acid sensor comprising:

a) depositing an electrode on a substrate;

b) coating the electrode with a redox polymer and an enzyme that generates a detection compound in the presence of a substrate; and

c) selectively coupling a sensor nucleic acid to the electrode by electrophoretic deposition.

50. The method according to claim 49 wherein the step of coating the electrode with a redox polymer comprises electrophoretically depositing the redox polymer onto the electrode.

51. A method of making an array for detecting target nucleic acid, the method comprising steps of:

a) depositing a plurality of electrodes on a substrate;

b) coating the plurality of electrodes with a redox polymer and an enzyme that generates a detection compound in the presence of a substrate; and

c) selectively coupling a sensor nucleic acid to one or more of the electrodes by electrophoretic deposition.

52. The method according to claim 51 wherein the step of coating the plurality of electrodes with a redox polymer comprises electrophoretic deposition of the redox polymer onto the plurality of electrodes.